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The 1986 Return of Even Year Pink Salmon to the Johnstone Strait Study Area

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by

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ABSTRACT

Stefanson A.P., L. Hop Wo, A.P. Gould and A.Y. Federenko. 1989. The 1986 Return of Even Year Pink Salmon Stocks to the Johnstone Strait Study Area. Can. MS Rep. Fish. Aquat. Sci. 2024 : 42 p.

The 1986 fishing plans for the Johnstone Strait Study Area were developed by the Department of Fisheries and Oceans (D.F.O.), in conjunction with the development of Fraser River Panel Area plans by the Pacific Salmon Commission (P.S.C.). The fishing season for commercial gillnets and seines opened August 3, and closed September 6. The number of days fishing in statistical Areas 12 and 13 totalled 14.5 gillnet and 10.0 seine days, the lowest since the 1978 cycle.

A stock assessment program was conducted jointly by D.F.O. and P.S.C. using gillnet and seine test vessels to determine the run strength and stock composition of sockeye stocks.

Pink salmon commercial catches and escapements in the Johnstone Strait Study Area were 600,000 and 1,400,000 respectively. The total returning pink stock was approximately 2.0 million including hatchery contributions. The 1986 return of 2.0 million pink salmon were produced from a 1984 brood escapement of 388,000.

The total commercial catch of sockeye in the Johnstone Strait fishery was 2.3 million. This catch was predominantly Fraser River sockeye in origin and was less than anticipated due to a lower than expected diversion rate (25%) through Johnstone Strait.

The Study Area sockeye escapement (excluding the Fraser River component) was estimated at 53,400 and is one of the lowest escapements on record. The exploitation rate of 1986 Study Area sockeye was 7.8% with the total stock estimated at 58,000.

Key words: pink salmon, sockeye salmon, Johnstone Strait Study Area, fishery, escapement.

RÉSUMÉ

Stefanson, A. P., L. Hop Wo, A. P. Gould and A. Y. Federanko. 1989. The 1986 Return of Even Year Pink Salmon to the Johnstone Strait Study Area. Can. MS Rep. Fish. Aquat. Sci. 2024 : 42 p.

Le ministère des Pêches et des Océans (M.P.O.) a élaboré les plans de pêche de 1986 pour la zone expérimentale du détroit de Johnstone conjointement avec la dévelopment des plans de la région du comité de la rivière Fraser par la commission du saumon du Pacifiquè. La saison de pêche commerciale à la senne et au filet maillant a duré du 3 août au 6 septembre. Dans les zones statistiques 12 et 13, le nombre total de jours de pêche s'est élevé à 14,5, pour la pêche au filet maillant, et à 10.0, pour la pêche à la senne; ces valeurs sont les plus faibles notées dupuis le cycle de 1978.

Le MPO et la CSP ont réalisé conjointement un programme d'évaluation de stock, par l'entremise d'une pêche expérimentale au filet maillant et à la senne, afin d'établir l'importance de la remontée et la composition des stocks du saumon rouge.

Les prises commerciales et l'échappée de saumon rose dans la zone expérimentale du détroit de Johnstone s'élevaient respectivement à 600 000 et à 1 400 000 saumons. Le nombre total de saumons en remontée se situait à environ 2,0 millions, y compris les saumons d'élevage. La remontée de 2.0 millions de saumons roses en 1986 provenait d'une échappée de 388 000 géniteurs en 1984.

Les prises commerciales totales de saumon rouge dans le détroit de Johnstone ont atteint 2,3 millions. Elles se composaient surtout d'individus provenant du fleuve Fraser et étaient inférieures aux prévisions à cause d'un taux de passage (25 %) par le détroit de Johnstone moins élevé que prévu.

Dans la zone expérimentale, l'échappée du saumon rouge (sauf la composante fleuve Fraser) a été estimée à 53 400 individus, soit une des plus faibles enregistrées. Le taux d'exploitation du saumon rouge dans cette zone en 1986 correspondait à 7,8 % d'un stock estimé de 58 000 saumons.

Mots-clés : saumon rose, saumon rouge, détroit de Johnstone, zone expérimentale, pêche, échappée.

1.0 INTRODUCTION

The Department of Fisheries and Oceans (D.F.O.) have biannually published condensed status reports on even year pink and sockeye salmon since 1962. These reports focus on salmon stocks originating from the Johnstone-Georgia Strait Study Area and on those Fraser River sockeye returning via the northern migration route.

The importance of recording management decisions and evaluating management results are documented and stressed by Pearce (1982) and Anon. (1982). Reports of this nature will ensure that past management actions are documented and serve as a data base for the transfer of knowledge amongst present and future managers.

This report provides a general overview of the weekly commercial fisheries activities during the 1986 fishing season. Included is a comprehensive documentation of the management strategies used in the 1986 Johnstone Strait Study Area (Statistical Areas 11-16) commercial fisheries, information used in making management decisions, how the information was interpreted and what the results were in terms of sockeye and pink catch. Escapement is also documented.

As a result of the ratification of the Canada/U.S. Pacific Salmon Treaty in March 1985, a bilateral Canadian/U.S. Fraser Panel was assigned the responsibility for the management of Fraser River sockeye and pink salmon harvests in the Fraser River Panel Area (Figure 1). The 1986 sockeye season was the first year that the Fraser Panel had responsibility for the development of pre-season plans, as well as in-season management of Fraser River sockeye within the Fraser River Panel area (Pacific Salmon Commission, May 1988). For non-Panel waters, particularly Johnstone Strait (Areas 11, 12, and 13) and Sabine Channel (Area 16), fishing plans which are the responsibility of D.F.O., were developed in concert with Fraser River sockeye objectives. This report documents the coordinated efforts and fisheries results in the Johnstone Strait Study Area for 1986.

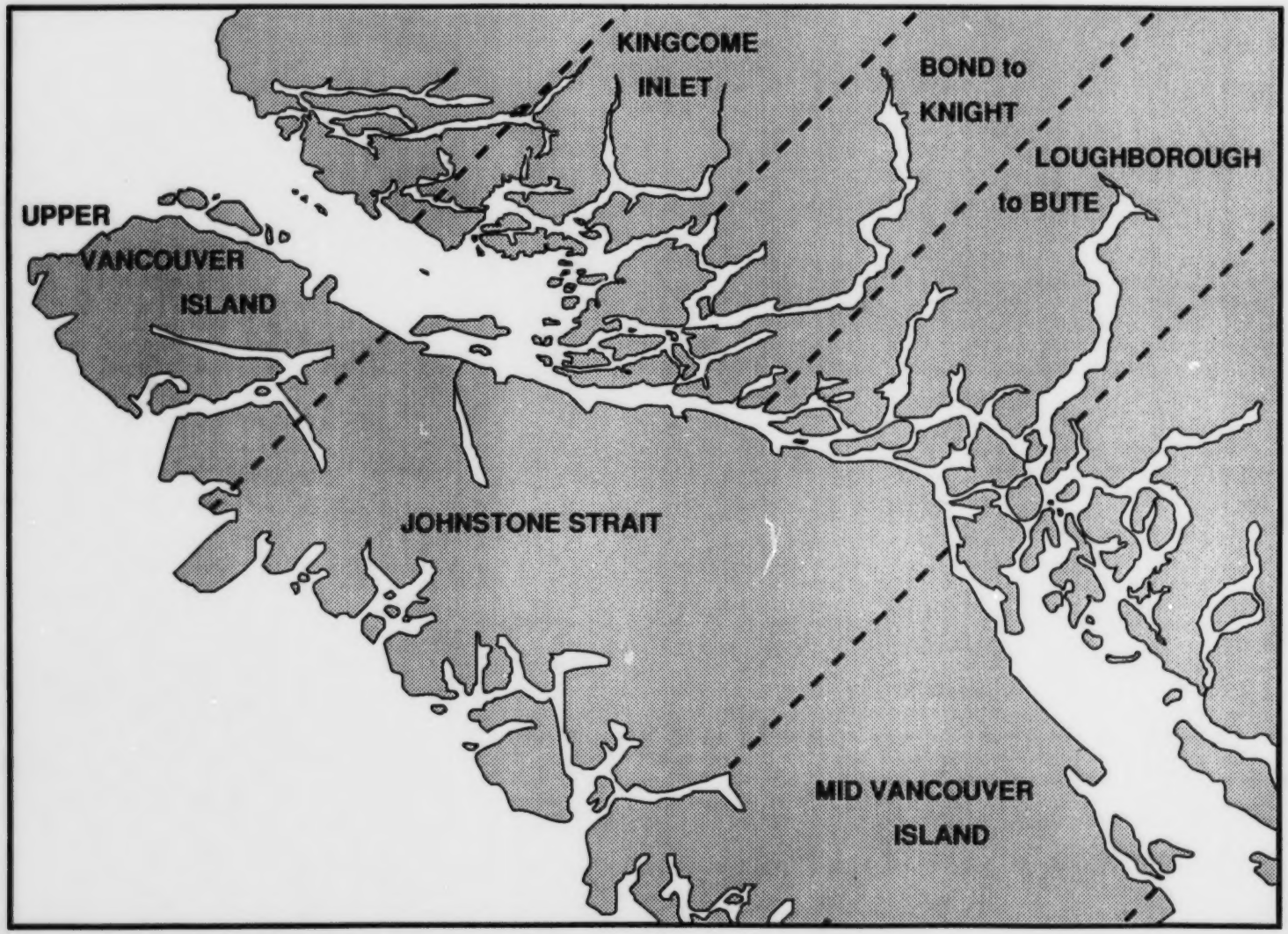

Figure 1. The Johnstone Strait Study Area

Showing major even year pink stock groups.

2.0 AREA and FISHERY DESCRIPTION

2.1 Area

The Johnstone Strait Study Area (Figure 1), consists of Johnstone Strait and waters of the Strait of Georgia north of the P.S.C. Fraser River Panel Area. For management purposes, the Study Area is divided into broad Statistical Areas (Figure 2) which in turn are further subdivided into sub-areas detailed by specific boundaries (Figure 3). All fishing areas remain "closed unless opened" by in-season regulation.

There are approximately 60 streams which contribute to the Study Area pink stock. All even year pink stocks spawn within the Study Area north of the Mid-Vancouver Island and Loughborough to Bute Inlet sub-areas. The migration of the Study Area pink stocks is entirely via the northern approach (through Johnstone Strait). Their run timing through Johnstone Strait generally extends from the end of July to mid-August.

Of the five rivers in the Study Area that support sockeye populations, the Nimpkish River is the most significant. The timing of these stocks which enter the area via the northern route usually extends from mid-May to mid-July.

2.2 Fishery

The current Johnstone Strait interception fishery in Area 12 and 13 is managed for Fraser River sockeye and generally harvests Study Area pinks and sockeye incidentally. During years of abundant Fraser sockeye and high fishing effort in Johnstone Strait, Study Area pink stocks are especially vulnerable in these fisheries. This is due to an overlapped migration timing and a similar migration route to those passing Fraser sockeye stocks. Terminal harvesting of pinks may occur, primarily in the mainland inlets of Area 12 which have historically supported large pink catches. In the past, these terminal fisheries usually included an early fishery which was used as an indicator of returning stock strength. With the advent of major Fraser sockeye fishing in Johnstone Strait and the decline of Study Area pink stocks, mainland inlet fishing has become more restrictive.

In addition to the Johnstone Strait fishery, a limited harvest occurs in Sabine Channel (Area 16). Historically, this fishery has targeted upon surplus Fraser sockeye prior to their entering the Fraser River terminal area.

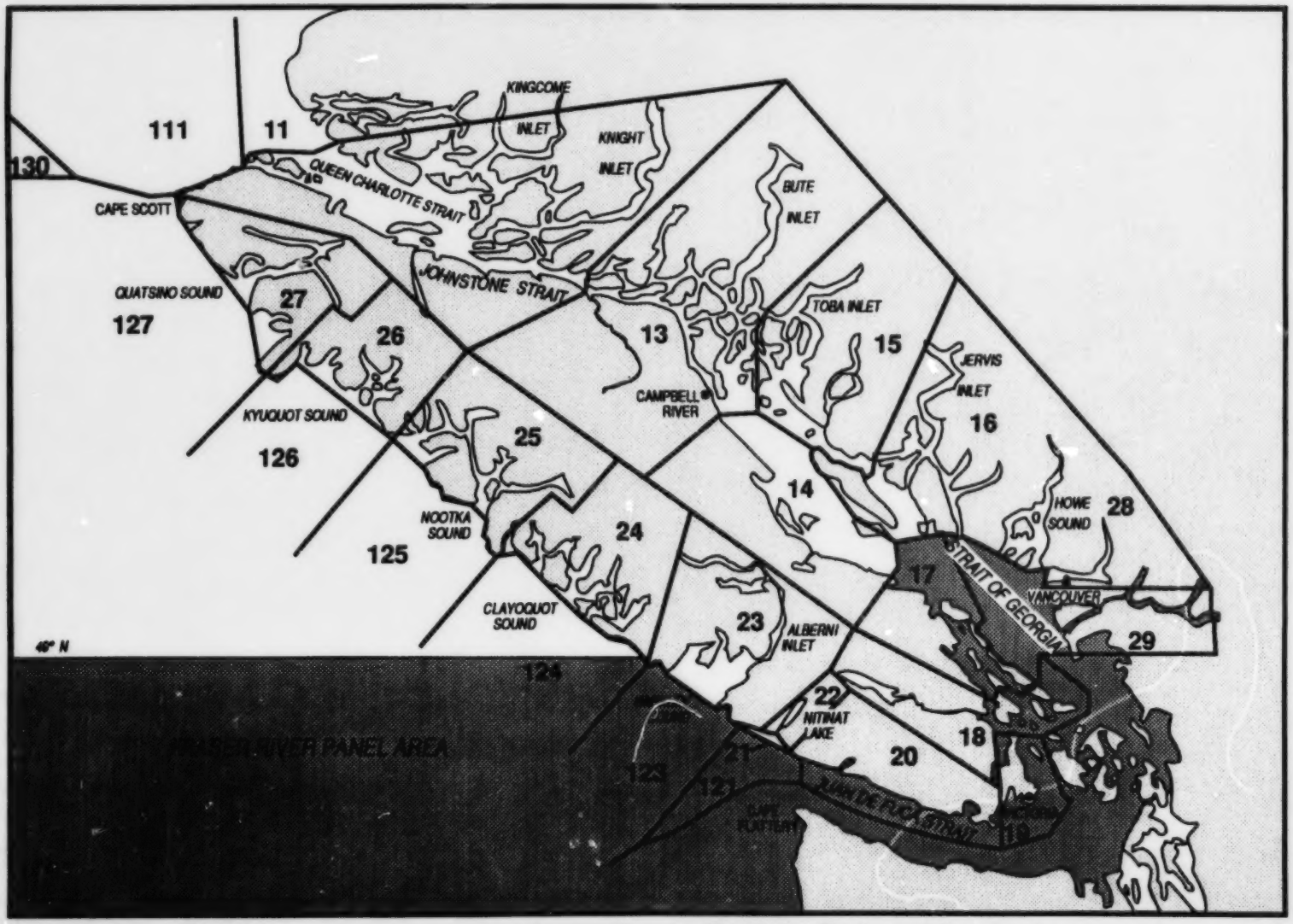

Figure 2. Statistical area map of southern British Columbia and adjacent waters.

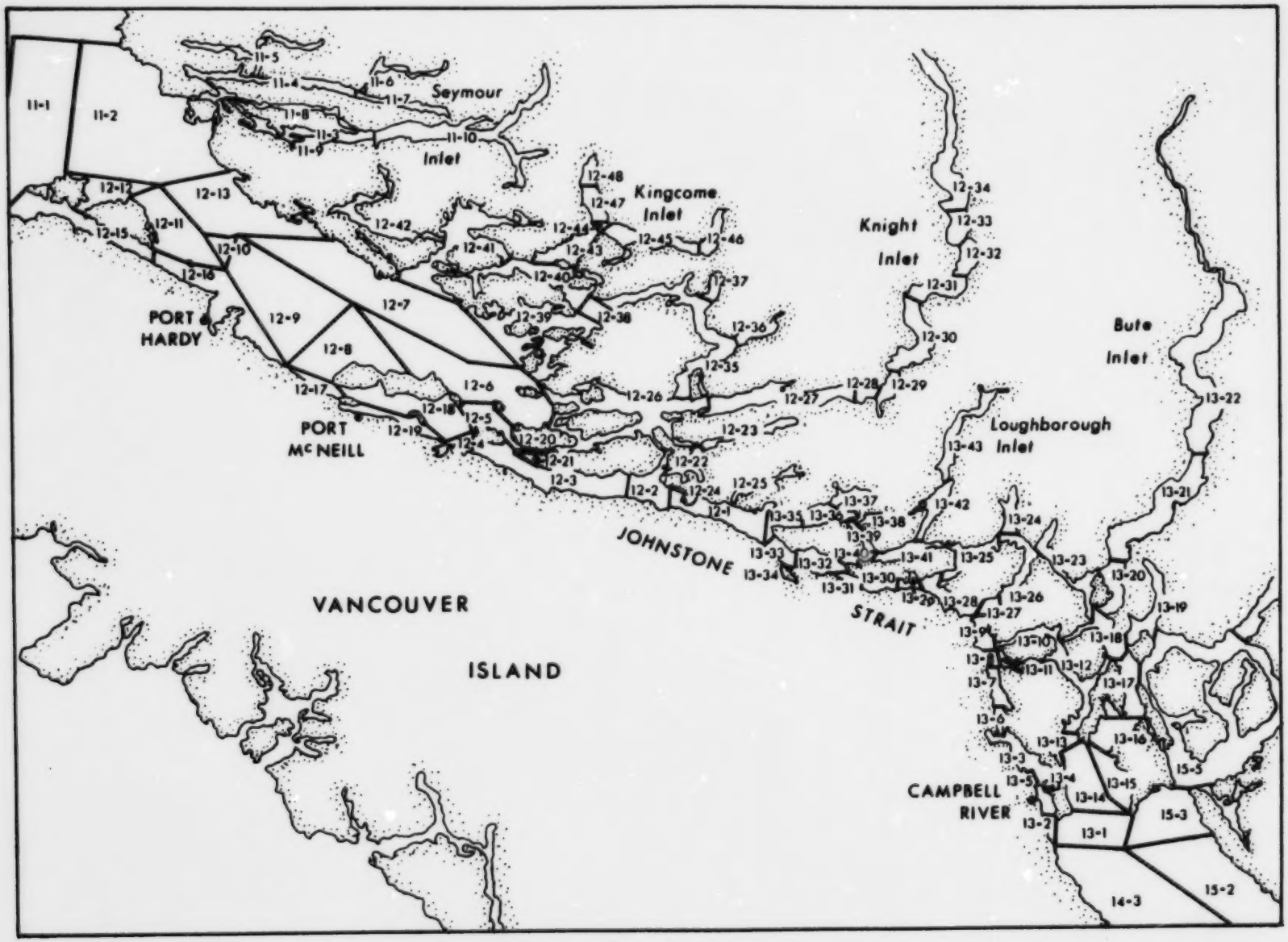

Figure 3. Statistical Sub-Area map of Johnstone Strait.

A major factor in determining the abundance of Fraser stocks in Johnstone Strait is the rate at which sockeye migrate via Johnstone Strait, referred to as diversion. Prior to 1986, the higher diversion of sockeye through Johnstone Strait had increased the effort and overall harvest in the Study Area, often to the detriment of local sockeye and pink salmon stocks.

Exploitation of migrating Fraser River sockeye through Johnstone Strait is the major consideration in the development of management plans for the Study Area. However, protection of the Study Area pink salmon and sockeye stocks and the reduction of incidental chinook catches may modify the overall Johnstone Strait management strategy.

Since 1978, a larger than average segment of the Fraser River sockeye population has migrated through Johnstone Strait as presented below.

Year	Cycle year diversion rates on the Fraser sockeye returns
1976	21%
1977	18%
1978	57%
1979	27%
1980	70%
1981	67%
1982	22%
1983	80%
1984	31%
1985	33%
1986	22%

3.0 1986 MANAGEMENT APPROACH

3.1 Development of 1986 Management Plans

This section presents the general management approach and procedures followed by the South Coast Division of the DFO in developing pre-season fishing plans and conducting in-season management.

Historically, fisheries outside of the Fraser River Panel Area were not included in any Canada / U.S. sharing agreement. As a result, harvesting pressure was maximized in both the Johnstone Strait and West Coast Vancouver Island troll fisheries. The new Treaty Convention required all catch of Fraser sockeye, regardless of harvest location, must be accounted for by each country.

The development of fishing management plans in 1986 changed from other years as a direct result of the ratification of the Canada / U.S. Pacific Salmon Treaty in March 1985. The newly initiated Fraser Panel had responsibility for the management of Fraser River sockeye within the Fraser River Panel Area. For those waters outside the Fraser Panel Area, particularly Johnstone Strait and Sabine Channel, fishing times and area plans which are the responsibility of D.F.O., were developed in conjunction with the Fraser River Panel to achieve the Fraser River sockeye objectives. Once fishing options were technically developed, managers then met with various industry and advisory groups including the Fraser Panel, South Coast Advisory and Outside Troll Advisory to finalize the fishing plan.

Final fishing plans and stock expectations are published in a D.F.O. information bulletin titled "Salmon Expectations". It is intended that this pre-season forecast of stock strength and proposed fishing plans serve as a guideline only. These fishing plans are dependant upon the anticipated stocks returning at the expected abundance and may require modification in-season.

3.2 Management Objectives and Considerations

The development of fishing plans consider several objectives. These include Fraser sockeye abundance, Study Area pink and sockeye abundance, required escapement, diversion rate, migration timing, international and domestic allocations and considerations of incidental catches of other species particularily chinook salmon. These management considerations and objectives form the basis for the development of the fishing plans.

3.2.1 Study Area Pinks

In order to protect an anticipated return of just over 1,000,000 Study Area pinks, which was substantially less than the required optimum of 1.4 million, conservation measures were to be provided during the Fraser sockeye fishery. These measures included delayed openings and area closures as well as the reduced fishing effort for chinook conservation (see appendix 1). Should harvestable stocks have returned to the Mainland Inlets, specifically the Kakweiken and Glendale rivers, it was proposed to

harvest these terminally.

3.2.2 Study Area Sockeye

Study Area sockeye expectations were for a poor return in 1986. In order to meet the required target escapement of 305,000 spawners, conservation measures were required to protect the Study Area sockeye. In particular, the dominant Nimpkish stock which generally peaks in the first three weeks of July was to be protected by a timing closure until July 27, and area closure (Area 11 and upper Area 12). It was anticipated that only small numbers of Study Area sockeye would be caught, primarily in outside troll fisheries prior to this date.

3.2.3 Fraser Sockeye

Management considerations and objectives for the Johnstone Strait summer fishery are primarily concerned with the harvest of passing Fraser River stocks. The primary Fraser River concerns are biologically related factors combined with catch sharing allocations.

The D.F.O. set a 1986 net escapement objective for Fraser River sockeye of 4.1 million spawners. In addition, 500,000 sockeye were allocated to the Indian Food Fishery resulting in a gross escapement requirement of 4.6 million sockeye. The International Treaty requirement stipulated that the United States was to receive 24% of the Total Allowable Catch (T.A.C.). Canadian domestic allocations are presented in section 3.2.5.

Migration timing of Fraser sockeye is forecast based on environmental factors. These factors such as sea surface temperatures and salinity are correlated with Gulf of Alaska data resulting in an estimation of stock timing. The 1986 analysis indicated the majority of Fraser River sockeye stocks would arrive approximately one week later than normal. Consequently, the initiation of the 1986 Johnstone Strait fishery was anticipated to be delayed depending on the actual timing of the run.

3.2.4 Chinook

Incidental chinook catches during the Fraser sockeye fisheries was to be reduced in accordance with the Canada/U.S. treaty. In 1986, the harvest rate of chinook in the Johnstone Strait net fishery was to be reduced by 25% from the base years 1979-1982. This was interpreted and implemented as a 25% reduction in vessel days. The fishing plans also included annual specific time and area closures such as extended time for the "Ribbon Boundary" and

a commercial closure of Parsons Bay. These regulations were in effect to minimize the chinook catch in conjunction with pink conservation.

3.2.5 Allocation

The Canadian commercial portion of the sockeye T.A.C. was further allocated by gear under the direction of the Ministerial Advisory Council. This resulted in a domestic allocation for seines (47.5%); gillnets (29.7%); outside troll (20.5%) and inside troll (2.3%), plus an additional 100,000 which was reallocated from the gillnet and seine allocation to the inside troll fishery. There was no allocation of Study Area pinks in 1986.

4.0 1986 PRESEASON EXPECTATIONS

4.1 Study Area Pinks

Pre-season expectations of wild pink returns were based upon brood year escapements and past average productivity rates. Included in the forecast is a potential adjustment of the expected productivity based on local field staff determination of environmental conditions. In addition to forecasting wild pink stocks, an estimation of the enhanced production was determined using Salmon Enhancement Program bio standards and fry output statistics.

The 1986 expected return of Study Area pink salmon, based on the brood year escapement of 387,500 was projected to be just over 1.0 million. These included returns to the mainland inlets of Area 12 and 13 (Kingcome/Wakeman, Bond to Knight, Loughborough/Bute) and to Upper Vancouver Island streams. This was below the optimum escapement requirements of 1,366,000 and no terminal pink fisheries were anticipated for the 1986 season. However, an incidental harvest of pink salmon was expected during the Johnstone Strait sockeye fishery.

4.2 Study Area Sockeye

Study Area sockeye escapements for brood years 1981 and 1982 were below optimum, and 1986 returns were not expected to meet the total Study Area sockeye optimum escapement requirement of 303,500. The dominant Nimpkish River run which consists primarily of four and five year old fish (Anderson 1976) had brood escapements of only 60,000 for both brood years. Based on brood escapements and the results of juvenile enumeration programs in Nimpkish Lake (lake trawl and echo sounding), the 1986 return was expected to be

approximately 200,000 adults. With an escapement requirement of 250,000, no directed fisheries (other than a minor Nimpkish Indian Food fishery in June) on Nimpkish sockeye or other Study Area sockeye stocks were anticipated for the 1986 season.

4.3 Fraser Sockeye

The 1986 Fraser River sockeye run as forecasted by D.F.O. was expected to total 14.0 million. A net required escapement of 4.1 million would leave approximately 9.5 million available for harvesting. Of this total, 400,000 sockeye had been allocated to the Fraser River Indian Food Fishery, leaving 9.1 million for the potential commercial harvest (T.A.C.) by Canada and the U.S. It should be noted that an additional 100,000 sockeye were to be reallocated to the Indian Food Fishery from the 1986 Canadian commercial allocation.

5.0 PRESEASON FISHING PLANS

5.1 Areas 11, 12, 13 and 16

The Johnstone Strait Study Area pre-season fishing plans outlined below for 1986, were developed to achieve escapement and allocation requirements. Briefly, Areas 11, 12 and 13 were scheduled to open the week of July 27 - August 2 and close the week of August 24-30 for a total of five fishing weeks. The Area 16 opening was delayed by two weeks giving only three fishing weeks commencing the week of August 10-16.

Weekly openings by gear for Area 11 (gillnets only), Area 12 and Area 13 were to be 1.5-3.5 days/week for gillnets and 1.0-2.0 days/week for seines, giving a season total of 12.5 gillnet days and 7.0 seine days. Area 16 was allocated 1.0-2.0 days per week for gillnets and seines for a seasonal total of 5.0 days.

Proposed fishing pattern for the Johnstone Strait Study Area (Statistical Areas 11, 12, 13 and 16), 1986.

Week	Starting time	Days	Area open
Area 11			
To July 26	--	--	Closed
July 27 - Aug 9	1800 Sunday	1.5 GN	Sub-area 11-11 and that portion of 11.2 westerly of a line from Bright Island to

Week	Starting time	Days	Area open
			Pine Island to the Apex of 11-2 Cape Caution line. Note: Gillnets are provided an additional 12 hrs fishing at the close of the seine fishery. (Area 12 seine fishing times).
Aug 10 - Aug 16	1800 Sunday	2.5 GN	Sub-area 11-1 and that portion of 11-2 westerly of a line from Bright Island to Pine Island to the Apex of 11-2 Cape Caution line. Note: Gillnets will be provided an extra 24 hrs in addition to the 36 hrs allocated to harvest Adams River sockeye.
Aug 17 - Aug 30	1800 Sunday	3.5 GN	Sub-area 11-1 and that portion of 11-2 westerly of a line from Bright Island to Pine Island to the Apex of 11-2 Cape Caution line. Note: Gillnets will be provided an extra 24 hrs in addition to the 60 hrs allocated to harvest Adams River sockeye.
Aug 31			Closed for the balance.
<u>Area 12</u>			
To July 26	--	--	Closed
July 27 - Aug 2	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 12-1, 12-3, 12-4, 12-5, 12-6, 12-8, 12-9, 12-10, 12-11 and a portion of 12-12 easterly of a line from Greeting Point on Nigei Island to Cape James on Hope Island. Note: Gillnets are provided an additional 12 hrs of fishing at the close of the seine fishery.
Aug 3 - Aug 9	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 12-1, 12-3, 12-4, 12-8, 12-9, 12-10, 12-11 and a portion of 12-2 easterly of a line from Greeting Point on Nigei Island to Cape James on Hope Island. Note: Gillnets are provided an additional 12 hrs of fishing at the close of the seine fishery.

Week	Starting time	Days	Area open
Aug 10 - Aug 16	1800 Sunday	1.0 SN 2.5 GN	Sub-areas 12-1, 12-3, 12-4, 12-8, 12-9, 12-10, 12-11 and a portion of 12-12 easterly of a line from Greeting Point on Nigei Island to Cape James on Hope Island. Note: Gillnets are provided an extra 24 hrs in addition to the 36 hrs allocated to harvest Adams River sockeye.
Aug 17 - Aug 23	1800 Sunday	2.0 SN 3.5 GN	Sub-areas 12-1, 12-3, 12-4, 12-8, 12-9, 12-10, 12-11 and a portion of 12-12 easterly of a line from Greeting Point on Nigei Island to Cape James on Hope Island. Note: Gillnets are provided an extra 24 hrs in addition to the 60 hrs allocated to harvest Adams River sockeye.
Aug 24 - Aug 30	1800 Sunday	2.0 SN 3.5 GN	Sub-areas 12-1, 12-3, 12-4, 12-5, 12-6, 12-8, 12-9, 12-10, 12-11, 12-12. Note: Gillnets will be provided an extra 24 hrs in addition to the 60 hrs allocated to harvest Adams River sockeye.
Aug 31 - Sep 13	--	--	Closed
Sep 14 - Sep 20	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-10, 12-11, 12-12, 12-13, 12-21 and 12-24. Ribbon boundary will not be in effect this week.
Sep 21			Further fishing dependent on strength of chum return.
<u>Area 13</u>			
To July 26			Closed
July 27 - Aug 9	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 13-7, 13-8, 13-9, 13-28, 13-29, 13-30, 13-31, 13-32. Note: Gillnets are provided an additional 12 hrs of fishing at the close of the seine fishery.

Week	Starting time	Days	Area open
Aug 10 - Aug 16	1800 Sunday	1.0 SN 2.5 GN	Sub-areas 13-7, 13-8, 13-9, 13-28, 13-29, 13-30, 13-31, 13-32. Note: Gillnets are provided an additional 24 hrs in addition to the 36 hrs allocated to harvest Adams River sockeye.
Aug 17 - Aug 30	1800 Sunday	2.0 SN 3.5 GN	Sub-areas 13-7, 13-8, 13-9, 13-28, 13-29, 13-30, 13-31, 13-32. Note: Gillnets will be provided an extra 24 hrs in addition to the 60 hrs allocated to harvest Adams River sockeye.
Aug 31 - Sep 13	--	--	Closed
Sep 14 - Sep 20	1800 Sunday	1.0 SN 1.5 GN	Sub-areas 13-7 to 13-10, 13-27 to 13-32 and 13-35. Ribbon Boundary not in effect this week.
Sep 21			Further fishing dependent on strength of chum return.
<u>Area 16</u>			
To Aug 9	--	--	Closed
Aug 10 - Aug 16	1800 Sunday	1.0 SN 1.0 GN	Sub-areas 16-19 to 16-22. Note: 16-9, 16-20 and 16-22 will be reviewed on an individual sub-area basis with regard to potential seine grilse problems.
Aug 17 - Aug 30	1800 Sunday	2.0 SN 2.0 GN	Sub-areas 16-19 to 16-22.
Aug 31			Closed for balance.

1. Fishing times in Area 16 are the same for seine and gillnet.

2. Sabine Channel fishing times and areas will be adjusted for gillnets or seines to meet domestic allocation requirements.

6.0 THE 1986 FISHERY

6.1 Weekly Fishery Summary

Appendix 1 summarizes in-season management actions and details the rationale for modifications from the pre-season plans. The following is a detailed in-season weekly account of the fishery:

July 27-August 2 (week 7/5)

All areas remained closed due to the late return of Fraser bound sockeye.

August 3-9 (week 8/1)

The Johnstone Strait commercial fishery commenced Sunday, August 3 at 1800 hours in Areas 11, 12, and 13; Area 16 remained closed. Seines fished for 1.0 day and gillnets for 1.5 days. Only a portion of sub-area 11-2 was opened to limit access to returning local area chum stocks. The upper portions of Area 12 (12-18 to 12-12) were open as the main Nimpkish sockeye run had migrated through the fishing area. Double Bay (12-5) was opened with a restricted boundary given the majority of the Area 12 Inlet pink stocks had moved inside the mainland area. The Area 12 "Ribbon Boundary", south of a fishing boundary sign on the east side of Big Bay (Hanson Island), was in effect for seines to provide protection of Study Area pinks and passing chinook stocks. The "Ribbon Boundary" was also in effect in Area 13.

This week's fishery closed as scheduled without extension. The sockeye catch in Johnstone Strait was limited, based on a low diversion rate as determined from test fishing in Areas 20 and 12. Sockeye present in the fishery this week were Chilko Lake, Horsefly, Stellako and Seymour stocks.

August 10-16 (week 8/2)

The Johnstone Strait commercial fishery for this week commenced Sunday August 10 at 1800 hours in Areas 11, 12, 13 and 16. Seines fished for 2.0 days and gillnets for 3.5 days, except for 2.0 gillnet days in Area 16.

This week's catch in Areas 11 and Area 12 suggested that the expected diversion and abundance of Adams River sockeye was not entering the Johnstone Straits. The present trend also suggested that the diversion rate through Johnstone Strait could be as low as 25%. Preliminary racial analysis of Area 12 test fish samples on August 6 confirmed the passing stocks as comprised of 50% summer run stocks, primarily Chilko, Horsefly, late Stuart and Stellako. The

summer run strength continued to hold up and the total summer stock size was upgraded by the Pacific Salmon Commission to 3.2 million sockeye, from the earlier forecast of 2.4 million.

Based on the catch of pinks in this week's fishery, average weights and positive reports from observations in the inlets, it appeared that Study Area pink stocks were returning with substantial strength.

August 17-23 (week 8/3)

The Johnstone Strait commercial fishery for this week commenced Sunday, August 17 at 1800 hours in Areas 11, 12, 13, and 16. Seines were originally scheduled for 2.0 days and gillnets for 3.5 days, with only 2.0 gillnet days scheduled for Area 16. Based upon the overall strong sockeye catches, a decrease in pink catches, and a generally "clean" fishery, a one day extension was announced for all gear in all areas.

The decline in pink catches this week indicated the "tail" of the Study Area pink run. Aerial monitoring of the mainland inlets suggested that a large portion of the pink stocks were either approaching or already behind the sanctuary boundaries. The majority of Adams River sockeye continued to return via the southern route as determined by Area 20 racial analysis and the Pacific Salmon Commission's estimated diversion rate remaining at 25-30% through Johnstone Strait. Racial stock analysis was not available this week for Area 12. However, preliminary analysis of samples from the Area 20 test fishery indicated stocks returning via the west coast were comprised of 80-90% late (Adams) stocks. The peak of the Adams River stocks was expected to return through the Straits on August 21. The catch during week 8/4 was expected to compare to that of the past week.

August 24-30 (week 8/4)

The Johnstone Strait- Strait of Georgia fishery for this week commenced Sunday , August 24 at 1800 hrs. in Areas 11, 12, 13 and 16. As in the week previous, seines and gillnets operated in Areas 12, 13, and 16 and gillnets in Areas 11, 12, 13 and 16. Seines were scheduled for 2.0 days, gillnets in Areas 11, 12 and 13 for 3.5 days, and only 2.0 days scheduled for Area 16.

An extension of 24 hours was announced for seines in all areas and for gillnets in Area 16. The additional fishing time was allocated based upon the continued good sockeye catches in lower Area 12 and in Area 13.

The abundance of sockeye available in Johnstone Strait this week did not increase dramatically from that of last week based upon catch and comparable gear effort. Also, catches in the upper portions of Area 12 continued to be poor despite more favourable tides in the

latter part of the fishery. This indicated a possible decline in the diversion of inside migrants and the end of the sockeye run. However, the D.F.O. troll test catches in Area 125 to August 25 indicated that the Adams River stock strength was continuing to hold on the west coast.

August 31-September 6 (week 9/1)

The Johnstone Strait commercial fishery opened on Monday, September 1 at 1800 hrs. in Areas 11, 12, 13 and 16 to harvest the late migration of Fraser sockeye. This additional week of fishing was not anticipated in the pre-season plan. Seines this week, fished for 1.0 day and gillnets for 1.5 days with only 1.0 gillnet day allotted for Area 16.

No extensions were announced as lower than anticipated sockeye catches prevailed throughout the district. This week's total catch in pieces was comprised of approximately 70% sockeye with the remaining 30% equally split between pink, chum and coho.

The Johnstone Strait pink and sockeye fishery was closed for the balance.

6.2 Season Catch Summary

Tables 1 summarizes, for pink and sockeye respectively, the total season catches by gear and area. Annual catches for the 1978-1984 cycle years are included for comparison. Weekly catches by gear for the Johnstone Strait as a whole are shown in Table 2. Weekly catches by gear for individual Statistical Areas are detailed

Table 1. Pink and Sockeye salmon catch by gear and area in the Johnstone Strait Study Area, 1986.

YEAR	GILLNET	SEINE	TROLL	TOTAL
1986 Pink				
Area 11	42,886	0	28,734	71,620
Area 12	108,244	314,360	2,592	425,196
Area 13	2,804	70,915	1,871	75,590
Area 14	130	0	1,466	1,596
Area 15	0	0	188	188
Area 16	44	233	1	278
Total	154,108	385,508	34,852	574,468
Percent by gear	(26.8)	(67.1)	(6.1)	(100.0)
1986 Sockeye				
Area 11	135,840	0	45,510	181,350
Area 12	466,867	1,109,758	8,017	1,584,642
Area 13	27,100	333,124	59,852	420,076
Area 14	355	2	3,291	3,648
Area 15	0	0	112	112
Area 16	10,596	52,149	8,320	71,065
Total	640,758	1,495,033	125,102	2,260,893
Percent by gear	(28.3)	(66.1)	(5.5)	(100.0)

Source: British Columbia Catch Statistics, DFO.

Table 2. Weekly catch of pink and sockeye by gear in the Johnstone Strait Study Area (combined Areas 11-16), 1986.

Week Ending		Pink				Sockeye			
		GN	SN	TR	Total	GN	SN	TR	Total
To 28-Jun		0	0	62	62	0	0	85	85
05-Jul	7/1	0	0	229	229	0	0	33	33
12-Jul	7/2	0	0	443	443	0	0	457	457
19-Jul	7/3	53	0	4,518	4,571	159	0	813	972
26-Jul	7/4	116	0	8,670	8,786	364	0	3,288	3,652
02-Aug	7/5	521	0	8,464	8,985	585	0	3,627	4,212
09-Aug	8/1	41,180	69,268	4,366	114,814	58,273	53,646	8,762	120,681
16-Aug	8/2	51,217	142,904	4,631	198,752	116,017	203,451	34,311	353,779
23-Aug	8/3	45,716	74,519	2,295	122,530	343,362	503,293	21,629	868,284
30-Aug	8/4	10,173	46,953	389	57,515	106,405	657,557	36,229	800,191
06-Sep	9/1	3,405	35,883	779	40,067	12,352	72,082	14,204	98,638
13-Sep	9/2	0	0	0	0	1	0	1,455	1,456
20-Sep	9/3	1,119	13,110	0	14,229	1,437	3,725	32	5,194
27-Sep	9/4	28	211	6	245	358	45	60	463
After 27-Sep		580	2,660	0	3,240	1,445	1,234	117	2,796
TOTAL		154,108	385,508	34,852	574,468	640,758	1,495,033	125,102	2,260,893

Source: British Columbia catch Statistics.

in Table 3 for pinks and in Table 4 for sockeye. The total (all gear) catch of pink salmon in Johnstone Strait in 1986 was 574,468. This catch was greater than the pre-season expectation due to a higher than expected stock return. The total (all gear) catch of sockeye salmon in the Johnstone Strait Study Area in 1986 was 2,260,893 and was taken primarily from stocks returning to the Fraser River. This catch represents a less than anticipated harvest due to a lower than expected diversion rate through Johnstone Strait.

6.2.1 Catch by Area

The majority of the Johnstone Strait pink catch (74.0%) came from Area 12, followed by Area 13 (13.2%) and Area 11 (12.5%). A similar catch distribution was observed for sockeye salmon, with Areas 11, 12, and 13 contributing 8.0%, 70.1% and 18.6% respectively. Compared to the recent cycle years of 1978-1984, the 1986 pink catch has since shifted from Areas 12 to Areas 11 and 13 by approximately 10% (see below). The 1986 sockeye catch distribution by area was similar to that of recent years except for a marked increase of 7.5% in Area 11 over the past 2 cycle year average (see below data calculated from tables 1 and 2).

Comparison of annual percent catch by Statistical Area

	PINKS			SOCKEYE		
Year	Area 11	Area 12	Area 13	Area 11	Area 12	Area 13
1978	5.2	87.4	7.1	4.0	69.1	25.7
1980	6.3	87.2	6.1	1.0	63.1	27.5
1982	4.6	83.9	10.0	2.2	65.2	25.6
1984	5.8	82.5	10.5	1.5	71.0	22.1
1986	12.5	74.0	13.2	8.0	70.1	18.6

Source: British Columbia Catch Statistics, D.F.O.

6.2.2 Catch by Gear

Seine catches dominated the 1986 harvest of pinks (67.1%) and sockeye (66.1%), followed by gillnets (26.8% of pinks and 28.3% of sockeye) and troll (6.1% of pinks and 5.5% of sockeye). For both pink and sockeye, the 1986 seine component was about 10-15% lower compared to the recent cycle years of 1978 to 1984 (Gould et al. 1988) with the gillnet component gaining in importance due to the Johnstone Strait gillnet/seine allocation.

Table 3. Weekly catches of pink salmon by gear and area in the Johnstone Strait Study Area, 1986.[a]

WEEK ENDING		AREA 11			AREA 12			AREA 13			AREA 14			AREA 15			AREA 16		
		GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR
To 28-Jun		-	-	15	-	-	-	-	-	39	-	-	7	-	-	-	-	-	1
05-Jul	7/1	-	-	148	-	-	75	-	-	-	-	-	5	-	-	1	-	-	-
12-Jul	7/2	-	-	433	-	-	2	-	-	4	-	-	4	-	-	-	-	-	-
19-Jul	7/3	-	-	1,590	53	-	1,661	-	-	62	-	-	1,205	-	-	-	-	-	-
26-Jul	7/4	-	-	8,114	116	-	88	-	-	448	-	-	20	-	-	-	-	-	-
02-Aug	7/5	-	-	7,188	521	-	102	-	-	1,168	-	-	6	-	-	-	-	-	-
09-Aug	8/1	14,394	-	4,076	26,089	39,368	278	697	29,900	12	-	-	-	-	-	-	-	-	-
16-Aug	8/2	10,582	-	4,049	39,426	121,496	141	1,193	21,390	35	-	-	219	-	-	187	16	18	-
23-Aug	8/3	15,977	-	2,050	29,438	69,401	162	281	5,087	83	-	-	-	-	-	-	20	31	-
30-Aug	8/4	1,896	-	309	8,009	45,101	77	261	1,791	3	-	-	-	-	-	-	7	61	-
06-Sep	9/1	37	-	762	3,309	33,926	-	58	1,834	17	-	-	-	-	-	-	1	123	-
13-Sep	9/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20-Sep	9/3	-	-	-	1,060	4,604	-	59	8,506	-	-	-	-	-	-	-	-	-	-
27-Sep	9/4	-	-	-	-	211	6	28	-	-	-	-	-	-	-	-	-	-	-
After 27-Sep		-	-	-	223	253	-	227	2,407	-	130	-	-	-	-	-	-	-	-
TOTAL		42,886	0	28,734	108,244	314,360	2,592	2,804	70,915	1,871	130	0	1,466	0	0	188	44	233	1

[a] Source: British Columbia Catch Statistics, DFO.

Table 4. Weekly catches of sockeye salmon by gear and area in the Johnstone Strait Study Area, 1986.[a]

WEEK ENDING	AREA 11			AREA 12			AREA 13			AREA 14			AREA 15			AREA 16		
	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR	GN	SN	TR
To 28-Jun	-	-	2	-	-	-	-	-	-	-	-	83	-	-	-	-	-	-
05-Jul 7/1	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
12-Jul 7/2	-	-	322	-	-	13	-	-	-	-	-	122	-	-	-	-	-	-
19-Jul 7/3	-	-	706	159	-	10	-	-	61	-	-	36	-	-	-	-	-	-
26-Jul 7/4	-	-	2,875	364	-	11	-	-	402	-	-	-	-	-	-	-	-	-
02-Aug 7/5	-	-	2,882	585	-	34	-	-	700	-	-	11	-	-	-	-	-	-
09-Aug 8/1	15,643	-	4,905	40,168	23,012	1,157	2,462	30,634	547	-	-	1,283	-	-	-	-	-	870
16-Aug 8/2	20,765	-	25,532	85,998	127,872	2,868	5,270	64,906	4,803	-	-	790	-	-	82	3,984	10,673	236
23-Aug 8/3	89,261	-	7,562	240,344	415,354	2,467	8,185	74,577	10,410	-	-	58	-	-	-	5,572	13,362	1,132
30-Aug 8/4	9,895	-	342	87,512	498,967	1,457	8,346	138,362	31,347	-	-	22	-	-	29	652	20,228	3,032
06-Sep 9/1	276	-	352	9,995	41,933	-	1,693	22,263	11,582	-	-	44	-	-	-	388	7,886	2,226
13-Sep 9/2	-	-	-	-	-	-	-	-	-	1	-	713	-	-	1	-	-	741
20-Sep 9/3	-	-	-	1,124	2,425	-	313	1,300	-	-	-	12	-	-	-	-	-	20
27-Sep 9/4	-	-	-	64	45	-	294	-	-	-	-	-	-	-	-	-	-	60
After 27-Sep	-	-	-	554	150	-	537	1,082	-	354	2	117	-	-	-	-	-	-
TOTAL	135,840	0	45,510	466,867	1,109,758	8,017	27,100	333,124	59,852	355	2	3,291	0	0	112	10,596	52,149	8,320

[a] Source: British Columbia Catch Statistics, DFO.

Comparison of annual percent catch by gear

Year	PINKS Seine	PINKS Gillnet	PINKS Troll	SOCKEYE Seine	SOCKEYE Gillnet	SOCKEYE Troll
1978	82.1	9.4	8.4	84.4	8.6	7.0
1980	73.4	16.0	10.5	91.1	7.2	1.8
1982	85.2	7.3	7.4	80.3	14.1	5.6
1984	80.8	12.2	7.0	75.8	23.2	1.0
1986	67.1	26.8	6.1	66.1	28.3	5.5

Source: British Columbia Catch Statistics, D.F.O.

6.3 Fishing Effort

Fishing effort (vessel counts) are determined primarily by aerial overflights and supplemented by information from local patrol vessels. Total gear distribution and effort throughout Johnstone Strait in 1986 was similar to past years. This was attributed to simultaneous openings in the Fraser River and the Juan de Fuca Strait areas, primarily the result of southern diversion. During the 1986 net fishery, gillnets fished for 13.0 days and seines for 9.0 days in each of Areas 12 and 13. Weekly gear counts (seine and gillnet) and days fishing are shown for each area in Table 5. This fishing effort data is based on a 13 week period when the fleet was targeting on pink and sockeye salmon. Catch occurring after this date is not considered in this analysis since the target species had shifted to chum salmon. The 1986 season was the shortest since 1978 and represents a progressive decline since 1978.

6.4 Stock Timing

6.4.1 Study Area Pinks

Run timing of the major Study Area pink stock groups through Area 12 is shown in Figure 4. Each major group is identified within the annual pink catch based upon earlier tagging program information (Anderson 1976). Figure 4 and Table 3 illustrate the approximate annual run timing of Study Area pink stocks during the 1978-1986 cycle years, as indicated by the weekly pink total catches in Area 12.

In 1986, the peak weekly catch of pinks in Area 12 totalled 161,063 and occurred during the week of August 10-16 (week 8/2). This peak timing is similar to the 1956-1970 cycle, when the average peak catch occurred around August 16. This timing would suggest increased production from the more southern migrating Johnstone Straits and Loughborough-Bute stocks which is substantiated by the escapement records.

Table 5. Weekly gear counts (seine and gillnet) and days fished for Areas 11-13 and 16, 1986.

	AREA 11		AREA 12				AREA 13				AREA 16				TOTAL			
	Vessels	# Days	Vessels		Days	Open	Vessels		Days	Open	Vessels		DAYS	OPEN	Vessels		DAYS	OPEN
WEEK	GN	GN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN
7/5	0	closed	0	0	closed		0	0	closed		0	0	closed					
8/1	101	1.5	301	95	1.5	1.0	21	20	1.5	1.0	0	0	closed		444	115	1.5	1.0
8/2	N/A[a]	3.5	340	129	3.5	2.0	6	47	3.5	2.0	14	9	2.0	2.0	352	185	3.5	2.0
8/3	75	4.5	414	187	4.5	3.0	15	39	4.5	3.0	12	10	3.0	3.0	519	236	4.5	3.0
8/4	40	3.5	374	187	3.5	3.0	13	39	3.5	3.0	35	10	3.0	3.0	440	236	3.5	3.0
9/1[b]	6	1.5	212	136	1.5	1.0	46	56	1.5	1.0	32	31	1.0	1.0	310	223	1.5	1.0
SEASON TOTAL		14.5			14.5	10.0			14.5	10.0			9.0	9.0			14.5[c]	10.0[c]

Note : Bute Inlet data not included.
The Study Area pink and sockeye fishery was officially terminated on week 9/1.
Total season days applies to Areas 11 (GN only), Area 12 and Area 13, but not Area 16.

[a] Gear counts not available due to heavy fog.

[b] The Study Area pink and sockeye fishery was officially terminated on week 9/1

[c] Total season days applies to Area 11 (GN only), Area 12 and Area 13, but not to Area 16.

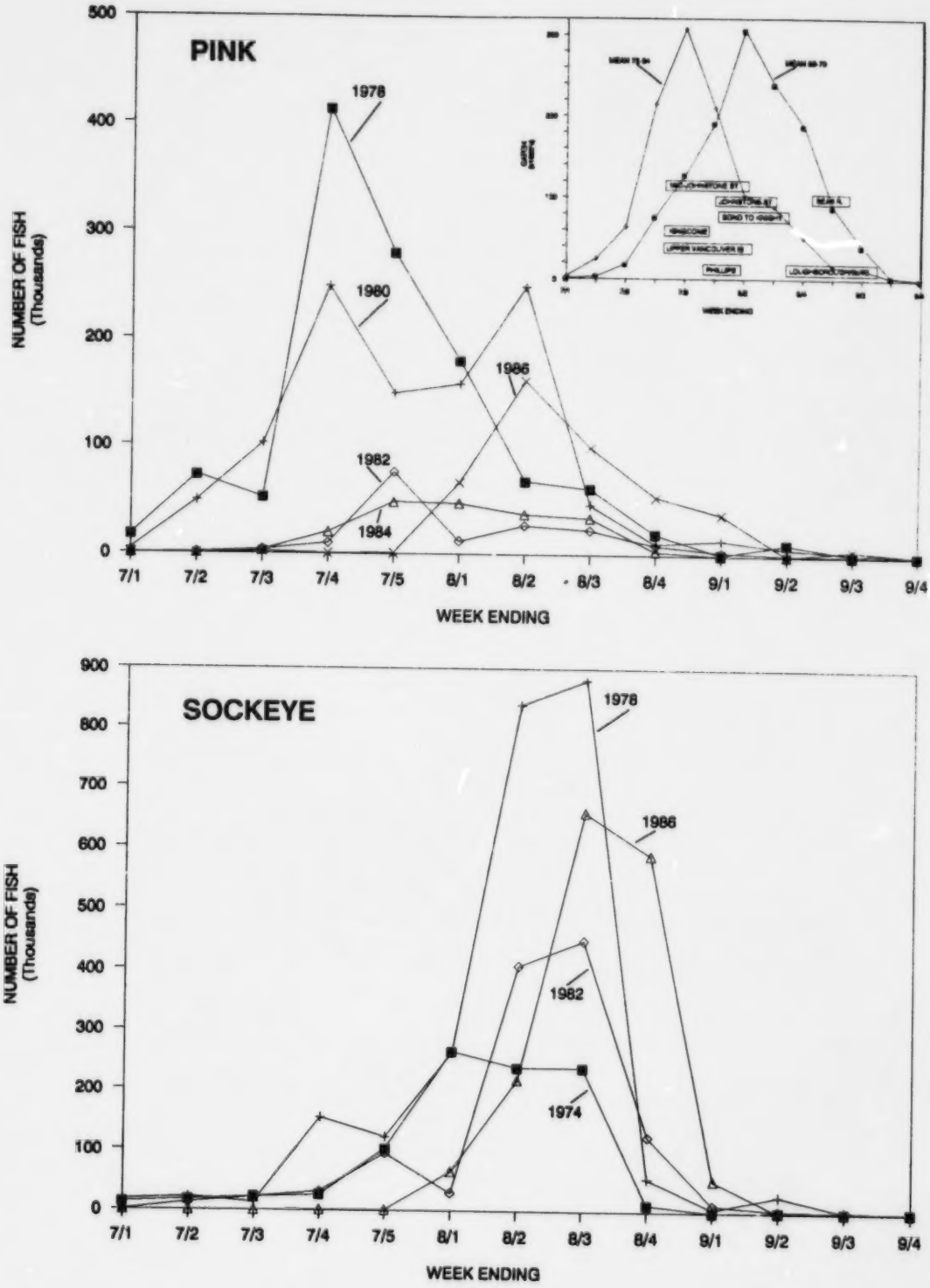

Figure 4. Weekly total catches of pink salmon and sockeye salmon in Area 12 for 1978 - 1986 (even years).

6.4.2 Fraser River Sockeye

Figure 4 also illustrates the approximate run timing of sockeye in relation to pink salmon through the Johnstone Strait area. Run timing is indicated by the weekly total catches in Area 12 where the majority of sockeye are harvested. Detailed are the cycle year catches for 1974, 1978, 1982 compared to 1986.

In 1986, the sockeye run was dominated by the late run Adams/Lower Shuswap stocks and was expected to peak in Johnstone Strait around mid-August. The actual peak timing occurred during August 17-23 (week 8/3) and August 24-30 (week 8/4) when 658,165 and 587,936 sockeye respectively were harvested in Area 12 (Table 4). The timing was approximately one week later than anticipated pre-season when compared to recent cycle years of 1978 and 1982.

6.4.3 Sockeye Test Fishery

In 1986, the Department of Fisheries and Oceans and the Pacific Salmon Commission conducted a joint sockeye test fishery in Area 12 using seine and gillnet test vessels. Testing commenced on July 14 by gillnet and on August 14 by seine, and ended on August 31 and August 29 respectively. Test catches provided continuous data on run strength while the weekly scale sampling and analysis provided information on racial stock composition and diversion rates. Table 6 shows the daily and mean weekly test catches by seine and gillnet while Figure 5 compares the weekly test and commercial catches.

The comparison between gillnet and seine test catches with Area 12 commercial net catches should be reflective of the sockeye run strength. For this first year of operation however, the gillnet test catches appeared to be a poorly correlated indicator of sockeye abundance (J.Cave pers. comm.), possibly the result of disruptive effects of poor weather conditions on the gillnetting operation and set location difficulties.

6.4.4 Indian food fishery

The annual Indian food fish catches in the Johnstone Strait-Strait of Georgia for years 1970-1986 are presented in Table 7. The 1986 food fishery totalled 1,714 pink salmon and 20,467 sockeye. The majority of the pink harvest (80.6%) came from Areas 12, while the majority of sockeye (96.3%) were harvested equally between Areas 12 and 13.

Table 6. Johnstone Strait Sockeye seine/gillnet test fishery: daily catches, total effort and catch per unit effort (CPUE), 1986.

Seine Test	DATE	SOCKEYE CATCH	# OF SETS	CPUE	DATE	SOCKEYE CATCH	# OF SETS	CPUE
	THU 14-Aug-86	1825	6	304.2	THU 28-Aug-86	303	6	50.5
	SAT 16-Aug-86	649	6	108.2	FRI 29-Aug-86	1052	6	175.3
	TOTAL 8/2	2474	12	206.2	TOTAL 8/4	1355	12	112.9
	FRI 22-Aug-86	2674	6	445.7				
	SAT 23-Aug-86	2268	5	453.6				
	TOTAL 8/3	4942	11	449.3				

Gillnet Test	DATE	CATCH	EFFORT	CPUE	DATE	CATCH	EFFORT	CPUE
	MON 14-Jul-86	29	67.6	0.43				
	TUE 15-Jul-86	26	68.6	0.38				
	WED 16-Jul-86	45	64.7	0.70				
	THU 17-Jul-86	18	75.4	0.24	THU 14-Aug-86	18	96.0	0.19
	FRI 18-Jul-86	40	93.3	0.43	FRI 15-Aug-86	52	95.5	0.54
	SAT 19-Jul-86	83	98.1	0.85	SAT 16-Aug-86	113	86.1	1.31
	TOTAL 7/3	241	467.7	0.52	TOTAL 8/2	183	277.6	0.66
	SUN 20-Jul-86	32	95.6	0.33				
	MON 21-Jul-86	41	93.3	0.44				
	TUE 22-Jul-86	42	84.4	0.50				
	WED 23-Jul-86	80	88.6	0.90				
	THU 24-Jul-86	31	97.8	0.32				
	FRI 25-Jul-86	55	96.2	0.57	FRI 22-Aug-86	213	98.5	2.16
	SAT 26-Jul-86	27	90.0	0.30	SAT 23-Aug-86	79	103.5	0.76
	TOTAL 7/4	308	645.9	0.48	TOTAL 8/3	292	202.0	1.45
	SUN 27-Jul-86	63	97.6	0.65				
	MON 28-Jul-86	83	96.3	0.86				
	TUE 29-Jul-86	63	97.7	0.64				
	WED 30-Jul-86	38	95.4	0.40				
	THU 31-Jul-86	134	100.7	1.33	THU 28-Aug-86	48	100.0	0.48
	FRI 01-Aug-86	177	95.2	1.86	FRI 29-Aug-86	18	103.7	0.17
	SAT 02-Aug-86	94	92.3	1.02	SAT 30-Aug-86	66	100.7	0.66
	TOTAL 7/5	652	675.2	0.97	TOTAL 8/4	132	304.4	0.43
	TUE 05-Aug-86	74	81.4	0.91				
	WED 06-Aug-86	117	71.5	1.64				
	THU 07-Aug-86	104	82.4	1.26				
	FRI 08-Aug-86	44	88.2	0.50				
	SAT 09-Aug-86	18	93.2	0.19	SUN 31-Aug-86	5	101.2	0.05
	TOTAL 8/1	357	416.7	0.86	TOTAL 9/1	5	101.2	0.05

Total effort = summed effort for all sets that day.
effort/set = mean time/set that the net is in the water, adjusted to 1,000 fathom net.

Table 7

Indian Food Fishery catches of pink salmon by statistical area, 1970-1986.

YEARS	STATISTICAL AREA									TOTAL
	12	13	14	15	16	17	18	19	20	INSIDE
86	650	333	0	0	0	0	0	0	0	983
85	3,347	1,908	0	0	0	0	0	0	0	5,255
84	1,000	2,463	0	0	N/A	0	0	0	0	3,463
83	3,392	10,192	0	0	5	0	0	0	0	13,589
82	73	1,419	0	0	15	0	0	0	0	1,507
81	2,270	900	3	0	3	0	0	0	0	3,176
80	N/A	315	0	0	0	0	0	0	0	315
79	5,000	598	0	N/A	15	0	0	0	0	5,613
78	2,000	140	N/A	N/A	0	0	0	0	0	2,140
77	350	1,143	N/A	0	186	50	0	0	0	1,729
76	1,700	92	0	0	0	0	0	0	0	1,792
75	500	2,313	0	0	0	0	0	0	250	3,063
74	350	215	0	0	0	0	0	0	0	565
73	1,271	951	0	0	0	0	0	0	0	2,222
72	1,912	52	0	5	0	0	0	0	0	1,969
71	549	455	0	0	28	0	0	0	0	1,032
70	94	21	0	0	0	0	0	0	0	115
AVERAGE	1,439	1,383	0	0	15	3	0	0	15	2,855

Indian Food Fishery catches of sockeye salmon by statistical area, 1970-1986.

YEARS	STATISTICAL AREA									TOTAL
	12	13	14	15	16	17	18	19	20	INSIDE
86	9,239	9,325	42	25	700	0	0	0	700	20,031
85	18,741	4,275	205	0	250	0	205	0	0	23,676
84	14,627	5,000	0	0	N/A	0	0	0	0	19,627
83	13,714	4,948	0	0	91	0	0	0	0	18,753
82	14,892	8,238	0	0	259	0	0	0	0	23,389
81	11,165	4,736	0	0	313	0	0	0	0	16,214
80	N/A	10,418	0	0	20	0	0	0	0	10,438
79	9,100	4,224	0	N/A	121	0	0	0	380	13,825
78	10,650	4,866	N/A	N/A	548	10	0	0	0	16,074
77	9,340	2,339	N/A	0	89	50	0	0	0	11,818
76	4,550	1,527	0	0	27	0	0	0	300	6,404
75	7,925	1,995	N/A	0	60	0	0	0	0	9,980
74	8,897	708	0	0	50	0	0	0	0	9,655
73	5,802	208	0	0	0	0	0	0	0	6,010
72	6,920	670	0	0	0	0	0	0	22	7,612
71	7,202	869	0	0	8	0	0	0	0	8,079
70	5,207	123	0	0	0	0	9	0	150	5,489
AVERAGE	9,292	3,792	15	1	149	4	13	0	91	13,357

n/a = not available, n/f = no fishery, uk = unknown

Source: -1985-1986 "Annual Pacific Indian Food Fishery Catch Statistics"
-1970-1984, (Bijsterveld, L. and M. James.1986 "Indian Food Fishery In the Pacific region: salmon catches, 1951 to 1984")

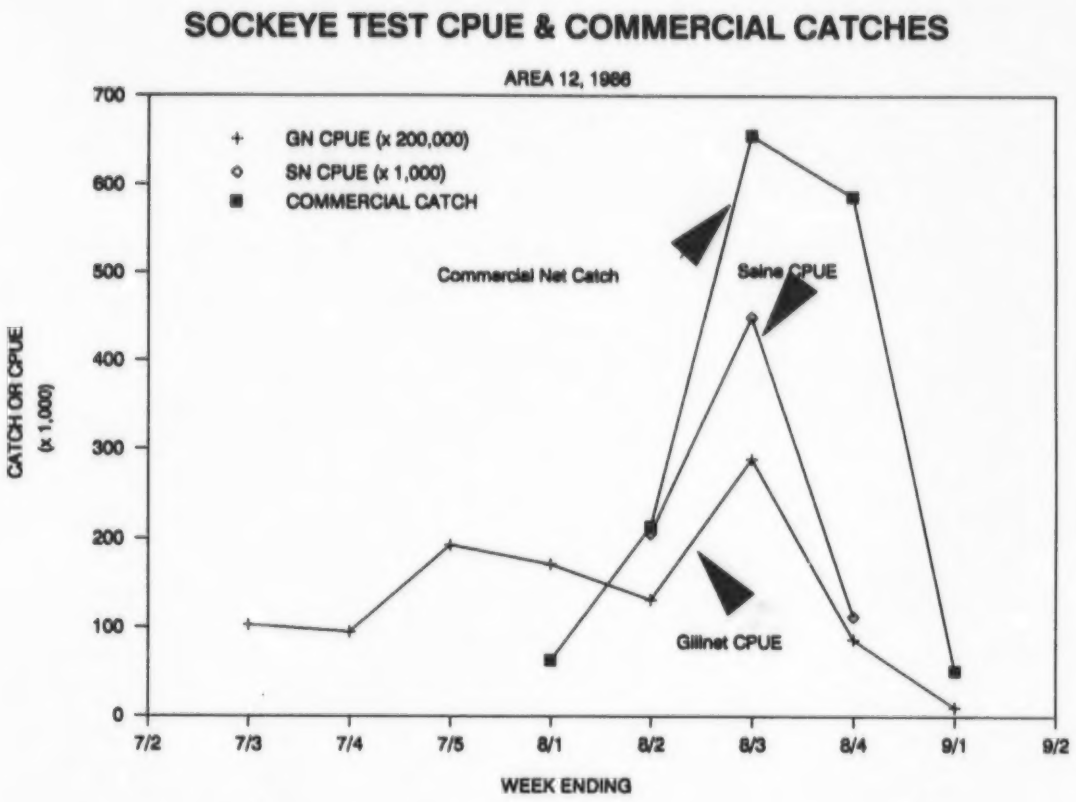

Figure 5. Comparison of weekly sockeye test fishing catches and commercial net catches in Area 12, 1986.

7.0 ESCAPEMENT

7.1 Study Area Pink Salmon

Study Area pink salmon escapements for the 1950-1986 cycle years are shown by stock in Figure 6 and Table 8, and by major streams in Appendix 2. Optimum escapements for each stream and sub-area are also included for comparison. The optimum escapements referred to are the highest that have produced an equal or greater escapement for even year stocks since 1950 with adjustments in some cases for updated information (Anderson 1976). During the management of the 1986 fishery, the optimum even year escapement of pinks to the Study Area was assessed at approximately 1.366 million.

The total Study Area escapement for 1986 was estimated at 1,380,700 pinks. The 1986 escapement was 3.6 times greater than the 1984 brood escapement and 1.5 times greater than the 1950-1986 cycle average escapement. The Bond to Knight sub-area was the dominant contributor (50.4%) to the Study Area escapement with Glendale and Kakweiken Rivers being the major producers (Appendix 2). The Upper and Mid-Vancouver Island and the Kingcome Inlet stocks showed similar escapements with each region contributing moderately to the Study Area total (12.5-17.1%). The lowest contribution was made by the Johnstone Strait and Loughborough to Bute sub-areas which together contributed only 7.4% to the Study Area total.

1986 Pink escapements by sub-area

Sub-area	Optimum Esc.	Escapement	% of Study Area Total
Bond to Knight	357.5	695.3	50.4%
Mid-Vancouver Island	38.9	235.7	17.1%
Kingcome Inlet	62.0	175.8	12.7%
Upper Vancouver Island	488.5	172.1	12.5%
Johnstone Strait	213.0	62.9	4.6%
Loughborough to Bute	206.4	39.0	2.7%
Total	1,366.3	1,380.7	100.0%

Considering individual stocks, the 1986 pink escapements were below optimum levels except for the Cluxewe, Keogh, Quinsam, Embly, Kingcome, Ahnuhati, Glendale and Kakweiken rivers and Wortley Creek. Compared with the last two cycle years (1982 and 1984), the

Table 8. Pink salmon escapements (in thousands) by sub-area to the Johnstone Strait Study Area, and percent of target 1960-1986 (even years).

SUB AREA TOTALS	TARGET ESCAPEMENT	1986	1984	1982	1980	1978	1976	1974	1972	1970
UPPER VANCOUVER IS	488.5	172.1	54.0	41.2	136.0	114.7	237.2	181.3	124.7	458.7
JOHNSTONE STRAIT	213.0	62.9	6.5	6.9	38.1	79.0	129.3	211.6	172.1	129.8
MID VANCOUVER IS	38.9	235.7	13.5	3.7	36.4	19.4	45.3	23.5	20.7	17.2
KINGCOME INLET	62.0	175.8	13.2	72.2	72.0	62.7	347.9	342.9	251.7	204.4
BOND TO KNIGHT	357.5	695.3	286.0	339.7	896.4	634.1	758.6	169.4	54.6	234.3
LOUGHBOROUGH/BUTE	206.4	39.0	14.3	110.0	204.4	138.6	170.3	195.6	90.8	109.4
GRAND TOTAL	1366.3	1380.7	387.5	573.7	1383.4	1048.4	1688.5	1124.2	714.6	1153.8

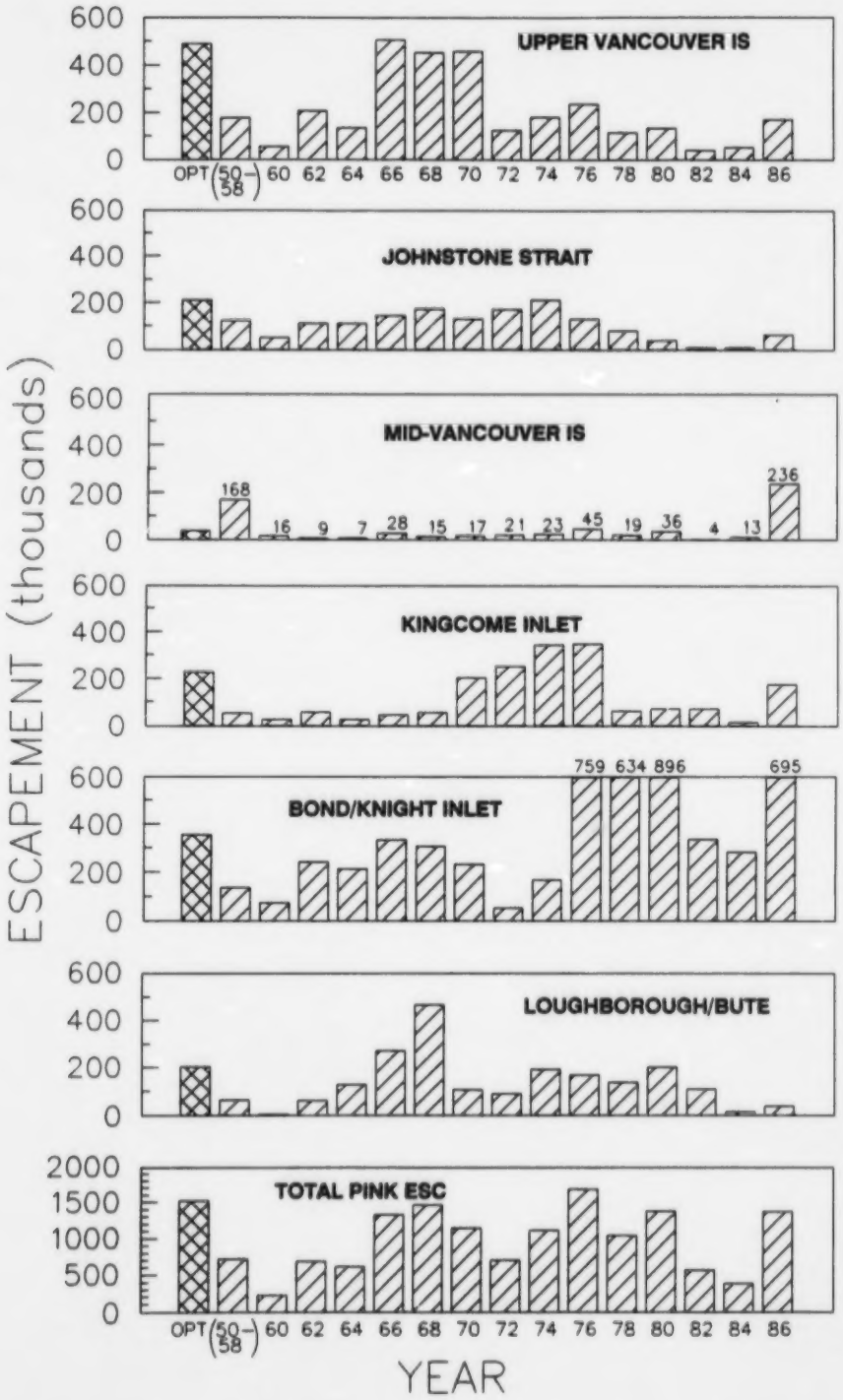
UPPER VANCOUVER IS
JOHNSTONE STRAIT
MID-VANCOUVER IS
KINGCOME INLET
BOND/KNIGHT INLET
LOUGHBOROUGH/BUTE
TOTAL PINK ESC
ESCAPEMENT (thousands)
YEAR
OPT (50-58) 60 62 64 66 68 70 72 74 76 78 80 82 84 86
168 16 9 7 28 15 17 21 23 45 19 36 4 13 236
759 634 896 695

Fig 6. Pink salmon escapements by sub-area to the Johnstone Strait study area for 1950 - 1986 cycle period (hatched bars indicate optimum escapement)

1986 cycle showed significant improvement in escapement for most stocks except for those returning to the Loughborough to Bute systems. The greatest increase since 1984 was observed in the Mid-Vancouver Island return and was attributed to the unexpected and substantial pink return to the Quinsam Hatchery.

7.2 Study Area Sockeye

Five significant sockeye stocks (Nimpkish, Fulmore, Heydon, Phillips and Sakinaw) are present in the Study Area. Their annual escapements are shown for all stocks during the period 1970 - 1986 in Table 9. The total escapement for 1986 was 53,400. The Nimpkish River system had an escapement of 40,000 and is by far the major sockeye producer in the Study Area. This system contributed 74.9% to the area total in 1986. Total sockeye escapements to the Study Area have declined from an average of about 102,000 in the 1950s and 1960s to about 65,000 in the 1980s.

Table 9. Sockeye salmon escapements (in thousands) to streams in the Johnstone Strait Study Area, 1970-1986.

Year	Nimpkish	Fulmore	Heydon	Phillips	Sakinaw	Total
1970	50.0	3.5	7.5	0.7	5.0	66.7
1971	75.0	7.5	4.5	3.5	8.0	98.5
1972	60.0	7.5	3.5	4.5	4.5	80.0
1973	100.0	10.0	3.5	3.5	1.5	118.5
1974	150.0	7.0	3.5	2.5	6.0	169.0
1975	40.0	6.0	3.5	1.5	16.0	67.0
1976	35.0	5.0	3.5	3.5	6.0	53.0
1977	15.0	1.5	3.5	1.5	1.2	22.7
1978	8.5	0.1	3.0	1.5	4.0	17.1
1979	20.0	0.5	2.0	1.5	11.0	35.0
1980	24.0	.1	2.0	2.5	2.8	31.4
1981	60.0	0.8	4.5	5.0	3.0	73.3
1982	60.0	1.5	1.0	10.0	3.4	75.9
1983	70.0	1.5	NO	10.0	1.6	83.1
1984	50.5	NO	1.0	1.5	1.1	54.1
1985	75.0	1.0	NO	7.1	2.3	85.4
1986	40.0	UK	2.5	5.5	5.4	53.4
AVERAGES						
70-79	55.4	4.9	3.8	2.4	6.3	72.8
80-86	54.2	0.7	1.6	5.9	2.8	65.2

Abbreviations used: NO - none observed
UK - unknown

POST SEASON REVIEW

8.0 Johnstone Strait - Strait of Georgia Fishery

The Johnstone Strait - Strait of Georgia commercial net fishery opened on August 3 and closed September 6, 1986. The fishery started one week later than scheduled due to the late run timing of Fraser summer stocks.

During the five week fishery, Areas 12 and 13 were opened for a total of 14.5 gillnet days and 10.0 seine days (note that only gillnets were allowed to fish in Area 11). This included an extension of 2.0 gillnet and 3.0 seine days over the pre-season plans in order to harvest the late returning Adams sockeye. Area 16 opened on August 10, one week later than the other areas and closed after four weeks of fishing, with a season total of 9.0 gillnet and 9.0 seine days. Even though the expected abundance was higher, the main factor in reducing the number of fishing days as compared to previous years was the late start of the 1986 season.

8.1 Study Area Pink

The total return of Study Area pink stocks was 1,380,700, compared to the pre-season forecast of 1,022,000. The higher than expected pink return is attributed largely to enhancement production, primarily from the Quinsam River Hatchery in lower Area 13. Monitoring of Mainland Inlets during the fishery resulted in no harvestable surplus being identified. The total Study Area pink catch of just under 0.6 million represented an incidental catch from a fishery targeting on Fraser sockeye. The peak migration based on incidental catches in the Study Area occurred during the second week of August with the bulk of the catch (74.0%) taken in Area 12. Purse seines harvested the majority (67.1%) of the Study Area catch. The overall exploitation of Study Area pink salmon was 29.4% for 1986 (Table 10).

8.2 Study Area Sockeye

Studies to date have indicated that the Nimpkish sockeye stock contributes to the Area 12 sockeye catch from mid-June until early August (Gould, A.P., and A.P. Stefanson. 1985). The peak catch of Nimpkish stocks occurs during mid-to-late July. The estimated catch of 4,600 in 1986 from an estimated total stock of 58,000 resulted in an exploitation rate of 7.8%. An escapement of all Study Area sockeye totalling 53,000 was one of the lowest on record.

Table 10. Catch, escapement, percent exploitation and ratio of return of the Johnstone Strait Study Area pink salmon, 1952-1986 (even years).

Year	Catch[a]	Escapement[b]	Total Stock	Percent Exploitation	Brood Escapement	Return to Escapement Ratio
1952	2,706,500	1,036,900	3,743,400	72.3%	662,320	5.7 : 1
1954	399,200	574,600	973,800	41.0%	1,036,900	0.9 : 1
1956	920,200	589,500	1,509,700	61.0%	574,600	2.6 : 1
1958	1,365,800	769,800	2,135,600	64.0%	589,500	3.6 : 1
1960	344,100	233,500	577,600	59.6%	769,800	0.8 : 1
1962	750,700	692,800	1,443,500	52.0%	233,500	6.2 : 1
1964	853,900	625,300	1,479,200	57.7%	692,800	2.1 : 1
1966	3,438,500	1,337,100	4,775,600	72.0%	625,300	7.6 : 1
1968	3,695,700	1,476,900	5,172,600	71.4%	1,337,100	3.9 : 1
1970	2,341,100	1,153,800	3,494,900	67.0%	1,476,900	2.4 : 1
1972	729,600	714,600	1,444,200	50.5%	1,153,800	1.3 : 1
1974	1,548,600	1,124,200	2,672,800	57.9%	714,600	3.7 : 1
1976	3,777,600	1,688,500	5,466,100	69.1%	1,124,200	4.9 : 1
1978	1,347,400	1,048,400	2,395,800	56.2%	1,688,500	1.4 : 1
1980	1,192,800	1,383,400	2,576,200	46.3%	1,048,400	2.5 : 1
1982	194,500	573,700	768,200	25.3%	1,383,400	0.6 : 1
1984	232,000	387,500	619,500	37.4%	573,700	1.1 : 1
1986	574,500	1,380,700	1,955,200	29.4%	387,500	5.0 : 1
AVERAGE						
52-86	1,467,400	932,800	2,400,200	55.0%[c]	892,900	3.1[d]: 1
76-86	1,219,800	1,077,000	2,296,800	44.0%[c]	1,034,300	2.6[d]: 1
80-86	548,500	931,300	1,479,800	34.6%[c]	848,300	2.3[d]: 1

[a] Source : British Columbia Catch Statistics, DFO.
[b] Source : DFO Spawning Files.
[c] Mean of annual percent exploitation values.
[d] Mean of annual ratios.

8.3 Other Salmon Species

The incidental net catch of chinook in Johnstone Strait during the 1986 season totalled approximately 18,000 and represented a considerable decrease from the 1985 catch of 38,000 and from the 1979-1983 average catch of 29,000 (Table 11). Catch reduction of chinook in 1986 can be attributed to reduced fishing time and specific area restrictions.

The catch of coho in Areas 11, 12, 13 and 16 totalled 59,523 pieces. The incidental catch of chum salmon totalled 78,852 by the end of the pink and sockeye fishery.

Table 11 . Annual net catches of chinook in combined Areas 11, 12 and 13, 1977-1986.

	GN		SN		TOTAL		TOTAL ADULT		
Year	ADULT	JACK	ADULT	JACK	ADULT	JACK	GN	SN	TOTAL
1977	10715	1454	38379	15573	49094	17027	10715	38379	49094
1978	10379	1876	44819	25151	55198	27027	10379	44819	55198
1979	5278	319	25891	11895	31169	12214	5278	25891	31169
1980	4885	960	24698	11950	29583	12910	4885	24698	29583
1981	4371	506	24249	13069	28620	13575	4371	24249	28620
1982	6487	600	23092	9649	29579	10249	6487	23092	29579
1983	3772	1059	24574	22260	28346	23319	3772	24574	28346
1984	4043	1120	14315	12820	18358	13940	4043	14315	18358
1985	5287	879	32759	4398	38046	5277	5287	32759	38046
1986	4927	793	12921	3327	17848	4120	4927	12921	17848
Average 79-83	4959	689	24501	13765	29459	14453	4959	24501	29459

Source: British Columbia catch statistics, DFO.
All catches are for the year until week ending 11-1.

9.0 ACKNOWLEDGEMENTS

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Appendix 1. Weekly net fishing season: pre-season plans, in-season management and rationale, Areas 11-13 and 16, 1986.

Date	Pre-season fishing plan: Area and (sub-area)	Days Fishing GN	Days Fishing SN	In-season management: Days extended GN	Days extended SN	Changes from pre-season	Rationale for alternation of pre-season plans
Jul 27 - Aug 2	11 (1,2 portion)	1.5	-	Closed		All areas remain closed.	Expected Fraser Sockeye diversion through Johnstone Strait is 50%. PSC announced that the summer run Fraser stock (Chilco run) is one week late. Indian Food Fishery catches in Johnstone Strait poor. Racial analysis of gillnet test fishing (Port Hardy area) indicates high Nimpkish sockeye composition and low Fraser stocks.
	12 (1, 3-6 8-11, 12 portion)	1.5	1.0	Closed			
	13 (7-9, 28-32)	1.5	1.0	Closed			
	16	Closed		Closed			
Aug 3 - 9 (wk 8/1)	11 (1, 2 portion)	1.5	-	-	-	Sub-area 12-5 open with restricted area boundary. Sub-area 12-12 portion open; restriction in this sub-area designed to harvest Fraser sockeye while leaving the remainder of sub-area closed to allow migration of Study Area pinks.	Sub-area 12-5 open to provide additional sockeye fishing area. Mainland Study Area pinks protected by delayed season opening until this week.
	12 (1, 3, 4, 8-11, 12 portion)	1.5	1.0	-	-		
	13 (7-9, 28-32)	1.5	1.0	-	-		
	16	Closed		Closed			
Aug 10 - 16 (wk 8/2)	11, (1, 2 portion)	3.5	-	-	-	Pre-season days fishing include pre-week decision for 1-day extension for GN and SN fisheries in all areas. Sub-area 12-5 open and sub-area 12-12 portion open. Sub-area 16-22 open.	Extension of 1 day was a pre-week decision and not an in week extension. Extension in all areas based on a lower diversion rate, from 50% pre-season to below 30% this week, and an increase in summer run Fraser sockeye to 3.5 million from 2.4 million (pre-season); indicators were test fishing data and commercial catches. Sub-area 16-22 opened to provide additional GN and SN fishing in Crescent Bay area for Fraser sockeye (minimal chinook catch).
	12 (1, 3, 4, 8-11, 12 portion)	3.5	2.0	-	-		
	13 (7-9, 28-32)	3.5	2.0	-	-		
	16 (19-22)	2.0	2.0	-	-		

(contd)

Appendix 1 (contd)

Date	Pre-season fishing plan: Area and (sub-area)	Days Fishing GN	Days Fishing SN	In-season management: Days extended GN	Days extended SN	Changes from pre-season	Rationale for alternation of pre-season plans
Aug 17 - 23 (wk 8/3)	11 (1, 2 portion)	3.5	-	1.0	-	1-day net extension in all areas.	Extension of 1 day in all areas to increase Johnstone Strait overall sockeye catch since a lower than expected diversion rate of 30% and lower than expected Adams River sockeye strength (Adams run delay by 5 days from normal). Whole sub-area 12-12 open (pre-week action) since pink run to Mainland Inlet is complete and closure is no longer needed. Sub-area 16-22 open for same reasons as previous week. Area 16 fishing days and times scheduled with Johnstone Strait seines.
	12 (1, 3, 4, 8-11, 12 portion	3.5	2.0	1.0	1.0	Sub-area 12-5 open.	
	13 (7-9, 28-32)	3.5	2.0	1.0	1.0	Whole sub-area 12-12 open (pre-week action).	
	16 (19-22)	2.0	2.0	1.0	1.0	Sub-area 16-22 open.	
Aug 24 - 30 (wk 8/4)	11 (1, 2 portion)	3.5	-	-	-	1-day extension for SN only in Areas 12 and 13; 1-day extension for both SN and GN in Area 16. Sub-area 13-27. Nodales Channel open (pre-week action).	500,000 Fraser sockeye TAC left for SN; extension was an attempt for additional sockeye harvest in Johnstone Strait since next week's sockeye run expected to decline (lower diversion of Adams run). Main body of sockeye was headed through Juan de Fuca. Previous days fishing was primarily of sockeye ("clean fishery") and current poor catches in area 11 suggested poor catches the following week (Adams run may dry up fast). Nodales Channel (sub-area 13-27) open as pink were clear of area; extension as above.
	12 (1, 3-6, 8-12)	3.5	2.0	-	1.0		
	13 (7-9, 28-32)	3.5	2.0	-	1.0		
	16 (19-22)	2.0	2.0	1.0	1.0		

(contd)

Appendix 2 (contd)

Date	Pre-season fishing plan: Area and (sub-area)	Pre-season fishing plan: Days Fishing GN	Pre-season fishing plan: Days Fishing SN	In-season management: Days extended GN	In-season management: Days extended SN	Changes from pre-season	Rationale for alternation of pre-season plans
Aug 31 - Sept 6 (wk 9/1)	11	Closed		1.5	-	Area 11 (1, 2 portion) open.	Due to total sockeye stock being at least one week late, the additional fishing at the end of the season was to harvest the remaining Adams TAC which was late in arrival. Sub-areas 13-10 and 13-27 open to provide increased sockeye fishing area. The "Ribbon Boundary" in effect in Areas 12 and 13. The pink and sockeye fishery in the Johnstone Strait Study Area is technically ended this week.
	12	Closed		1.5	1.0	Area 12 (1-6, 8-12) open. Area 13 (7-10, 27-32) open.	
	13	Closed		1.5	1.0	Area 16 (19-22) open.	
	16	Closed		1.0	1.0		
		Fraser Sockeye normal timing would dictate that the run would be over in Johnstone Strait.					
Sep 7 - 13 (wk 9/2)	11	-	-	Closed		All areas closed. Areas 11 and 16 closed for the balance of the season.	
	12	-	-	Closed			
	13	-	-	Closed			
	16	-	-	Closed			
Sept 14 - 20 (wk 9/3)	11	Closed		Closed		Commercial assessment fisheries in Area 12 and 13 scheduled for mid-week (Tuesday).	South Coast Chum Advisory requirements.
	12 (1-13, 21, 24)	1.5	1.0	-	-		
	13 (7-10, 27-32, 35)	1.5	1.0	-	-		
	16	Closed		Closed			

Extracted largely from Johnstone Strait and Gulf Management Action 1986 Review (DFO, unpubl.).

Appendix 2. Pink escapement (in thousands) to streams and sub-areas in the Johnstone Strait Study Area, 1970-1986(even years).

SUB AREA & RIVER	OPTIMUM	1986	1984	1982	1980	1978	1976	1974	1972	1970
UPPER VANCOUVER IS										
CLUXEWE R.	35.0	35	15.0	10.0	80.0	0.0	49.0	32.0	6.0	35.0
KEOGH R.	100.0	100.0	25.0	30.0	35.0	48.0	72.0	55.0	50.0	125.0
NAHWITTI R.	75.0	0.4	0.0	UN	UN	0.4	0.2	11.0	22.0	110.0
QUATSE R.	150.0	35	13.0	0.5	10.0	36.0	74.0	66.0	16.0	75.0
SHUSHARTIE R.	35.0	0.2	N/O	0.2	3.0	-	0.1	0.3	0.4	3.5
SONGHEES R.	3.5	N/O	N/O	0.3	-	2.3	3.5	3.0	1.8	0.2
STRANBY R.	75.0	UN	UN	UN	3.5	-	1.5	3.0	24.0	75.0
TSULQUATE R.	15.0	1.5	1.0	0.2	4.5	28.0	37.0	11.0	4.5	35.0
MISC.	-	-	-	-	-	-	-	-	-	-
TOTAL	488.5	172.1	54.0	41.2	136.0	114.7	237.2	181.3	124.7	458.7
JOHNSTONE STRAIT										
ADAM R.	50.0	35.0	4.0	4.8	20.0	50.0	55.0	60.0	50.0	15.0
BEAR R.	100.0	17.0	2.0	0.5	5.7	18.0	52.5	130.0	100.0	100.0
HYDE CR.	3.5	0.0	N/O	UN	0.3	UN	0.1	0.1	0.1	0.4
KOKISH R.	7.5	1.5	N/O	UN	N/O	N/O	UN	0.3	0.4	1.5
MENZIES R.	3.5	0.0	N/O	UN	0.1	-	0.2	0.4	0.4	0.8
MILLS CR.	7.5	0.2	N/O	UN	-	0.4	1.8	UK	0.4	0.8
MOHUN CR.	3.5	N/O	N/O	N/O	-	-	-	0.0	0.4	3.5
NIMPKISH R.	15.0	0.2	UN	1.5	7.5	1.7	0.4	12.0	12.0	4.0
SALMON R.	7.5	7.5	0.5	0.1	2.0	8.0	15.0	3.5	7.5	3.5
TSITIKA R.	15.0	1.5	0.0	N/O	0.6	0.8	4.0	5.0	0.8	0.0
MISC.	-	0.0	-	0.1	2.0	0.1	0.3	0.3	0.2	0.4
TOTAL	213.0	62.9	6.5	6.9	38.1	79.0	129.3	211.6	172.1	129.8
MID VANCOUVER IS										
CAMPBELL R.	7.5	10.0	0.5	0.5	1.5	1.1	10.0	4.0	3.5	3.5
ENGLISHMAN R.	0.4	N/O	N/O	0.0	0.1	0.0	0.0	0.0	0.0	0.1
OYSTER R.	3.5	0.1	0.0	0.2	5.0	0.4	0.9	0.9	1.1	1.6
PUNTLEDGE R.	5.0	0	0.1	0.7	6.2	1.6	0.4	0.9	2.5	1.0
QUINSAM R.	7.5	225.46	12.9	2.1	18.2	14.8	24.0	7.5	3.5	1.5
TSOLUM R.	15.0	0	0.0	0.2	5.0	1.5	10.0	10.1	10.0	6.9
MISC.	-	0.1	-	0.0	0.4	0.0	0.1	0.1	0.1	2.6
TOTAL	38.9	235.7	13.5	3.7	36.4	19.4	45.3	23.5	20.7	17.2
KINGCOME INLET										
CARRIDEN CR.	3.5	0.5	N/O	N/O	1.0	1.5	0.6	0.6	0.8	3.5
EMBLY R.	40.0	120.0	7.0	12.0	25.0	13.0	7.0	70.0	100.0	100.0
KINGCOME R.	15.0	31.0	2.2	24.0	20.0	20.0	280.0	190.0	75.0	25.0
WAKEMAN R.	3.5	24.0	4.0	35.0	25.0	25.0	55.0	81.0	75.0	75.0
MISC.	-	0.3	-	1.2	1.0	3.2	5.3	1.3	1.0	0.9
TOTAL	62.0	175.8	13.2	72.2	72.0	62.7	347.9	342.9	251.7	204.4

TABLE PINK ESCAPEMENTS (CON'D)

SUB AREA & RIVER	OPTIMUM ESCAPEMENT	1986	1984	1982	1980	1978	1976	1974	1972	1970
BOND TO KNIGHT										
AHNUHATI R.	35.0	150.0	50.0	85.0	340.0	120.0	100.0	15.0	3.0	35.0
AHTA VALLEY CR.	3.5	0.0	N/O	N/O	0.1	1.3	0.3	-	3.5	1.5
GILFORD(FRASER C.	0.8	0.0	0.0	0.2	UN	UN	UN	0.0	0.0	-
GLENDALE R.	150.0	240.0	125.0	150.0	250.0	275.0	150.0	30.0	9.5	150.0
HOEYA CR.	7.5	1.5	0.4	3.5	0.8	2.0	6.0	2.0	0.8	0.4
KAKWEIKEN R.	100.0	250.0	100.0	70.0	300.0	222.0	500.0	100.0	15.0	35.0
KAMAMO BAY CR.	3.5	0.0	0.0	0.0	0.1	0.1	0.1	0.5	1.0	3.5
KLINAKLINI R.	5.0	UN	UN	UN	UN	NO	0.3	0.1	0.8	0.8
KWALATE R.	0.8	1.1	0.2	0.2	0.1	N/O	0.1	UN	UN	UN
LULL CR.	1.5	0.5	0.5	0.7	0.6	0.2	1.5	1.5	0.4	0.4
NIGGER CR.		25								
VINER R.	15.0	0.0	UN	0.1	0.4	-	0.0	0.2	0.4	4.0
WATERFALL CR.	35.0	24.0	10.0	30.0	3.5	13.0	0.3	20.0	20.0	3.5
MISC.	-	3.2	-	0.1	1.0	0.6	0.1	0.1	0.2	0.3
TOTAL	357.5	695.3	286.0	339.7	896.4	634.1	758.6	169.4	54.6	234.3
LOUGHBOROUGH TO BUTE										
APPLE R.	0.2	0.1	N/O	N/O	2.0	3.5	4.0	-	1.5	5.0
CAMELEON HBR. CR.	15.0	1.5	0.3	1.5	8.0	2.5	1.5	5.0	3.5	7.5
CUMSACK CR.	1.5	UN	N/A	UN	N/O	-	-	-	-	-
EVA CR.	0.8	UN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FANNY BAY CR.	1.5	UN	N/O	N/O	-	-	-	-	0.0	1.5
FRASER CR.	3.5	0.3	N/O	UN	0.3	0.5	1.5	1.5	0.4	3.5
FULMORE R.	1.5	0.0	N/O	N/O	UN	UN	UN	UN	UN	UN
GRANITE CR.	7.5	0.0	0.0	N/O	UN	N/O	-	-	0.4	1.5
GRASSEY CR.	75.0	4.0	1.0	40.0	40.0	100.0	75.0	100.0	25.0	25.0
GRAYS CR.	7.5	1.0	0.3	1.0	0.6	1.8	0.8	7.5	0.8	3.5
HEYDON CR.	15.0	1.5	0.2	1.5	2.5	1.0	15.0	10.0	3.5	15.0
HOMATHKO R.	1.5	0.0	N/O	N/O	N/O	-	-	-	0.8	1.5
HYACINTHE CR.	0.8	0.0	N/O	UN	NO	-	-	-	-	0.2
KANISH CR.	7.5	0.0	N/O	N/O	N/O	-	-	0.1	3.5	4.0
ORFORD R.	0.4	N/O	N/O	N/O	N/O	0.1	-	-	-	0.2
PHILLIPS R.	35.0	12.0	2.0	2.5	30.0	10.0	50.0	35.0	35.0	15.0
READ CR.	15.0	1.5	2.5	3.5	45.0	3.5	12.0	20.0	7.5	7.5
STAFFORD R.	1.5	2.0	UK	N/O	1.0	0.8	1.5	3.5	1.5	3.5
SOUTHGATE R.	0.8	N/O	N/O	N/O	N/O	-	-	-	-	-
WORTLEY CR.	15.0	15.0	8.0	60.0	75.0	15.0	9.0	13.0	7.5	15.0
MISC.	-	0.1	-	-	-	-	-	-	-	-
TOTAL	206.4	39.0	14.3	110.0	204.4	138.6	170.3	195.6	90.8	109.4
GRAND TOTAL	1366.3	1380.7	387.5	573.7	1383.4	1048.4	1688.5	1124.2	714.6	1153.8

NOTE : N/O = NONE OBSERVED
UN = UNKNOWN